Application No. 10/673,996
Filed: September 29, 2003
TC Art Unit: 2882
Confirmation No.: 2809

AMENDMENTS TO THE CLAIMS

1. (currently amended) Apparatus for X-ray analysis of a sample, comprising:

an X-ray excitation source, which is arranged to irradiate a spot on the sample with an X-ray beam along a beam axis;

one or more X-ray detectors, which are arranged so as to define a ring around the spot, the ring having a gap therein at a location that is radially displaced from the beam axis, and ~~which~~ wherein the one or more X-ray detectors are adapted to receive X-ray photons from the spot on the sample and to generate a first signal in response to the photons that is indicative of a characteristic of the sample;

an optical radiation source, which is aligned with the X-ray excitation source so as to illuminate the spot on the sample with optical radiation; and

an optical detector, which is positioned in the gap in the ring so as to receive the optical radiation that is reflected from the sample, and to generate a second signal that is indicative of an alignment of the spot with a target area of the sample.

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2. (original) The apparatus according to claim 1, wherein the X-ray beam causes the sample to emit fluorescent X-ray photons, which are received by the one or more X-ray detectors, and wherein the first signal is indicative of a composition of a feature of the sample in the target area.

3. (original) The apparatus according to claim 1, wherein the optical radiation source is arranged to illuminate the spot from a position within the gap in the ring.

4. (original) The apparatus according to claim 1, wherein the X-ray excitation source comprises an X-ray optic, which is arranged to focus the X-ray beam onto the spot on the sample, and wherein the optical radiation source and the X-ray optic are configured so that the optical radiation is also focused onto the spot by the X-ray optic.

5. (original) The apparatus according to claim 1, and comprising a controller, which is adapted to align the X-ray

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excitation source with the sample responsively to the second signal, so that the spot is incident on the target area.

6. (currently amended) Apparatus for X-ray analysis of a sample, comprising:

an X-ray excitation source, which is adapted to generate an X-ray beam;

an optical radiation source, which is adapted to generate optical radiation;

~~an X-ray~~ a polycapillary optic, which is arranged to focus both the X-ray beam and the optical radiation onto a spot on the sample;

one or more X-ray detectors, which are adapted to receive X-ray photons from the spot on the sample, and to generate a first signal in response to the photons that is indicative of a characteristic of the sample; and

an optical detector, which is arranged to receive the optical radiation that is reflected from the spot on the sample, and to generate a second signal that is indicative of an alignment of the spot with a target area of the sample.

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7. (original) The apparatus according to claim 6, wherein the X-ray beam causes the sample to emit fluorescent X-ray photons, which are received by the one or more X-ray detectors, and wherein the first signal is indicative of a composition of a feature of the sample in the target area.

8. (original) The apparatus according to claim 6, wherein the one or more X-ray detectors are arranged so as to define a ring around the spot.

9. (canceled)

10. (currently amended) ~~The~~ Apparatus ~~according to claim 6, and~~ for X-ray analysis of a sample, comprising:

an X-ray excitation source, which is adapted to generate an X-ray beam;

an optical radiation source, which is adapted to generate optical radiation;

an X-ray optic, which is arranged to focus both the X-ray beam and the optical radiation onto a spot on the sample;

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one or more X-ray detectors, which are adapted to receive X-ray photons from the spot on the sample, and to generate a first signal in response to the photons that is indicative of a characteristic of the sample; ~~and~~

an optical detector, which is arranged to receive the optical radiation that is reflected from the spot on the sample, and to generate a second signal that is indicative of an alignment of the spot with a target area of the sample; and

a movable reflector, which is positionable to direct the optical radiation toward the X-ray optic during the alignment of the spot with the ~~feature~~ target area, and which is repositionable to permit the X-ray beam to impinge on the X-ray optic after the alignment is completed.

11. (original) The apparatus according to claim 6, and comprising a controller, which is adapted to align the X-ray optic with the sample responsively to the second signal, so that the spot is incident on the target area.

12. (canceled)

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13. (currently amended) A method for X-ray analysis of a sample, comprising:

aligning an optical radiation source with an X-ray excitation source, so that a spot on the sample that is irradiated by an X-ray beam generated by the X-ray excitation source along a beam axis is illuminated with optical radiation generated by the optical radiation source;

receiving the optical radiation that is reflected from the sample, and responsively to the received optical radiation, generating a first signal that is indicative of an alignment of the spot on the sample;

aligning the X-ray beam, responsively to the first signal, so that the spot coincides with a target area of the sample; and

receiving X-ray photons from the spot on the sample after aligning the X-ray beam, and responsively to the received X-ray photons, generating a second signal that is indicative of a characteristic of the target area,

wherein receiving the X-ray photons comprises arranging one or more X-ray detectors so as to define a ring around the spot, while leaving a gap in the ring at a location that is radially displaced from the beam axis, and

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wherein receiving the optical radiation comprises positioning an optical detector in the gap in the ring so as to receive the optical radiation that is reflected from the sample.

14. (canceled)

15. (original) The method according to claim 13, wherein receiving the X-ray photons comprises receiving fluorescent X-rays, which are emitted by the sample in response to the X-ray beam, so that the second signal is indicative of a composition of a feature of the sample in the target area.

16-17. (canceled)

18. (currently amended) ~~The~~ A method ~~according to claim 13~~ for X-ray analysis of a sample, comprising:

aligning an optical radiation source with an X-ray excitation source, so that a spot on the sample that is irradiated by an X-ray beam generated by the X-ray excitation source is illuminated with optical radiation generated by the optical radiation source;

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receiving the optical radiation that is reflected from the sample, and responsively to the received optical radiation, generating a first signal that is indicative of an alignment of the spot on the sample;

aligning the X-ray beam, responsively to the first signal, so that the spot coincides with a target area of the sample; and

receiving X-ray photons from the spot on the sample after aligning the X-ray beam, and responsively to the received X-ray photons, generating a second signal that is indicative of a characteristic of the target area,

wherein aligning the optical radiation source comprises irradiating an alignment target with the X-ray beam, so as to cause the target to emit light from a point on the target at which the X-ray beam is incident, and aligning the optical radiation source with the point on the target.

19. (new) A method for X-ray analysis of a sample, comprising:

arranging a polycapillary optic to focus both an X-ray beam generated by an X-ray excitation source and optical radiation produced by an optical radiation source, so that a spot on the

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sample that is irradiated by the X-ray beam is illuminated with the optical radiation in alignment with the X-ray beam;

receiving the optical radiation that is reflected from the sample, and responsively to the received optical radiation, generating a first signal that is indicative of an alignment of the spot on the sample;

aligning the X-ray beam, responsively to the first signal, so that the spot coincides with a target area of the sample; and

receiving X-ray photons from the spot on the sample after aligning the X-ray beam, and responsively to the received X-ray photons, generating a second signal that is indicative of a characteristic of the target area.

20. (new) The method according to claim 19, wherein receiving the X-ray photons comprises receiving fluorescent X-rays, which are emitted by the sample in response to the X-ray beam, so that the second signal is indicative of a composition of a feature of the sample in the target area.

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